4 Claims

1. Method for data processing, to be run on a data processing device, for the mapping of input data to output data, where:

   data objects to be processed are entered as input data,

   the entered data objects are processed, by using a topology-preserving mapping, by

   ordering of neurons in the ordering space, according to a given pattern,

   assigning of codebook objects in the outcome space to the neurons

   processing of codebook objects according to the calculation rule of a topology-preserving mapping, by use of data objects of the exploration space,

   output of the processed codebook objects as output data,

   thereby characterized that

   at least a part of the entered data objects is used to determine the order of neurons in the ordering space, and/or

   data objects, required for the data processing and independent of the input data to be processed, are entered, which are used as data objects of the exploration space.

2. Method as set forth in claim 1, where the data objects to be processed are distance objects.

3. Method as set forth in claims 1 or 2, where data objects in the ordering space are ordered irregularly.

4. Method as set forth in one of the claims above, where data objects of the ordering space, exploration space, and/or outcome space

   satisfy a non-Euclidian geometry,

   are used that are distance objects to data objects of a local neighborhood of data objects,

   represent data distributions with a fractal dimension,

   represent data distributions of non-orientable surfaces in the sense of differential geometry,

   are added, omitted or modified during the training process or a series of training processes of the topology-preserving mapping, this specifically for distance objects in the ordering space,

are influenced by additional constraints,

are saved and/or processed in local units

and/or

are added, omitted or modified after completion of the training of the topology-preserving mapping.

5. Method as set forth in one of the claims above, where the calculation rule of the topology-preserving mapping and/or at least one parameter of this calculation rule

   is chosen depending on the respective processed data object of the ordering space, exploration space and/or outcome space,

   is modified during the training process or over several training processes of the topology-preserving mapping, specifically if depending on the respective processed data object of the ordering space, exploration space, and/or outcome space,

   and/or

   is influenced by additional constraints.

6. Method for data processing, to be run on a data processing device, for the mapping of data objects to be processed to distance objects, where:

   data objects to be processed are entered,

   distances between the data objects to be processed are calculated as distance objects,

   these distance objects are delivered as output data,

   thereby characterized that

   the distances are calculated by use of statistical learning methods, local models, methods of inferential statistics, and/or one of the following specific computation methods:

   Levenstein Measure,

   Mutual Information,

   Kullback-Leibler Divergence,

   coherence measures employed in signal processing, specifically for biosignals,

   LPC cepstral distance,

   calculation methods that relate the power spectra of two signals, such as the Itakura-Saito Distance,

the Mahalanobis-Distance,
and/or
calculation methods relating to the phase-synchronization of oscillators.

7. Method for data processing, to be run on a data processing device, for the determination of the cluster validity,

   where data objects are entered,

   distance objects between these data objects are entered and/or calculated,

   and an assignment of the data objects to be processed to groups is entered and/or calculated, specifically according to a method as set forth in one of the claims 1 to 5,

   and a measure of the quality of this assignment is delivered as output data,

   thereby characterized that

   the measure of the quality of the assignment is calculated employing at least a part of the entered and/or calculated distance objects.

8. Method as set forth in claim 7, where the measure of the quality of the assignment is calculated by use of a method as set forth in claims 1 to 6 and/or a cost function of a method for the clustering of dissimilarity data.

9. Method as set forth in one of the claims above, to be carried out repeatedly, whereby the output data of a previous run of the procedure are entered as input data of a subsequent run of the procedure.

10. Method as set forth in one of the claims above, where the quality of the output data is determined and this determined quality is delivered.

11. Method as set forth in claim 10, where the quality is determined, by

    calculating measures for topology- and/or distribution-preservation,

    calculating distortion measures,

    relating the distances of data objects in the ordering space to the distances of corresponding data objects in the outcome space and/or exploration space, specifically by plotting these in a distance plot,

    graphically displaying data objects of the exploration, outcome and/or ordering space, specifically applying these to a exploration, outcome and/or ordering plot,

graphically displaying data objects calculated from data objects of the exploration, outcome and/or ordering space, specifically by plotting these in an exploration, outcome, and/or ordering plot,

calculation and output of the mapping error for interpolation, extrapolation, approximation, and/or supervised learning, specifically by forward and backward projection,

and/or

sequential processing of data objects.

12. Method as set forth in claim 10 or 11, where the determined quality is used for:

adding, omitting or modifying data objects of the exploration, outcome and/or ordering space of the topology-preserving mapping,

and/or

modifying the calculation rule of the topology-preserving mapping and/or its parameters, specifically, depending on data objects of the exploration, outcome, and/or ordering space.

13. Method as set forth in one of the claims above, where the data processing is used:

for dimension determination, specifically for the determination of fractal dimensions,

for non-linear embedding, specifically of non-metric data and/or dissimilarity data,

for clustering, specifically of non-metric data and/or dissimilarity data,

for determining the cluster validity, specifically of dissimilarity data and/or non-metric data,

for supervised learning, specifically on non-metric data and/or dissimilarity data,

for the registration of data sets,

for active learning,

for sorting,

for the optimization, specifically for non-metric data and/or dissimilarity data,

for finding solutions of Traveling Salesman Problems and equivalent problems, specifically non-metric Traveling Salesman Problems,

for the calculation of hyper-manifolds,

for interpolation, extrapolation, and/or approximation,

for relevance learning,

for the visualization of graphs,

for graph layout,

and/or

for the construction of self-developing, self-repairing, and/or self-reproducing systems, in particular of technical systems.

14. Method as set forth in claim 13, which is used in combination as in the following:

    dimension determination and non-linear embedding,

    non-linear embedding and calculation of hyper-manifolds,

    clustering and determination of cluster validity,

    and/or

    non-linear embedding and clustering.

15. Method as set forth in one of the claims above, where the data processing is applied

    to the molecular dynamics simulation, specifically where constraints, in particular rigid spatial relations, in the molecule and/or its surroundings, are modeled as distances of the neurons in the ordering space,

    to problem solving in the field of robotics, specially when constraints, notably rigid special relations, in the robot and/or its surroundings, are modeled as distances of the neurons in the ordering space,

    and/or

    to data in the fields of economics, finances, medicine, humanities, natural sciences, and/or technology, specifically

        in the fields of circuit design, bio-informatics, robotics, meteorology, image processing,

        in the field of data-mining, specifically text-mining,

        in the field of security technology, specifically flight and/or access security,

        in the field of logistics, specifically traffic control and maintenance systems,

        and/or

        in the fields of communication technology and/or cryptology.

16. Data processing device for running a method as set forth in one of the claims above.

17. Computer program product, which is stored in a memory medium and contains software code segments, with which steps as set forth in one of the method claims above are carried out, if the computer program product is run on a data processing device.